

---

# Toward a Definition of the Appropriateness of Dental Treatment

GERARD C. KRESS, Jr., PhD

AN IMPORTANT ASPECT of the quality of dental care is the appropriateness of the treatment delivered. Decisions related to the choice of treatment are complex, inadequately defined, and directly related to the costs of care. Unlike technical quality of single procedures, few criteria or systems have been developed for evaluation of the appropriateness of the overall treatment strategy. The consensus among the experts is that many factors are involved, including economic and psychological as well as physiological considerations, but that few objective rules exist to guide what is generally classified as a matter of professional judgment.

Dental educators agree that treatment planning is one of the weakest areas of the curriculum. Not enough clinical research has been done to provide empirical bases for selections among many treatment alternatives. Thus, if it were possible to better define the relative benefits of alternative approaches to treatment of dental conditions, two benefits would result. First, such a definition would ensure prescription of better treatment. Second, it would be helpful in the evaluation of the cost effectiveness of alternative treatment plans.

My purpose here is to review the literature related to the evaluation of the appropriateness of dental treatment in order to demonstrate where we are and where we need to go toward a better definition. The topics reviewed and my reasons for including them are as follows:

- The current state of the art in dental treatment planning.

- The broader area of evaluation of dental quality—to place appropriateness of treatment in that context.
- The role of the patient—to demonstrate that dental consumers influence their own treatment and need to be included in the definition process.
- The components of oral health and pathology—to clarify the range of problems addressed by dental treatment.
- Past research on diagnosis and treatment planning.

I also present some suggestions about specific lines of new research that can generate information to form a better basis for selection of dental treatment.

## Dental Treatment Planning

Currently, treatment planning in dentistry is better described as an art than as a technology. Critics of dental education often take the position that students are inadequately taught to integrate their clinical knowledge into sound patterns of treatment planning (1-4). A recently published survey of oral diagnosis curriculums revealed large variations in the number of hours devoted to instruction in treatment planning; most of the schools reported 10 hours or less in each year of the curriculum (5). The emphasis seems light for this complex and difficult area.

However, the problem may not be so much one of curriculum development. Rather, it may reflect a fundamental weakness in the way clinical dentistry has evolved as a collection of disciplines or specialty areas. Expertise generally exists along the lines of a particular clinical discipline, but few claim to be experts at integrating the various approaches to oral therapy—as evidenced by the chapter titles of some widely used

---

*Tearsheet requests to Dr. Gerard C. Kress, Jr., Director, Educational Research, Harvard School of Dental Medicine, 188 Longwood Ave., Boston, Mass. 02115.*

texts on oral diagnosis and treatment planning. For example, in two texts (6,7) few chapters include more than one clinical discipline; these chapters seem to be the exception to the general pattern of discipline-specific approaches to oral diagnosis and treatment planning.

Nevertheless, every general practitioner is required to design and follow a course of treatment for each of his or her patients. In fact, it has been suggested frequently that as routine tasks are increasingly delegated to auxiliaries, the dentist's role should shift more heavily toward that of diagnostician and treatment planner. How well dentists handle this aspect of dental care is a matter of much speculation. Several authors imply that diagnosis and treatment planning are seriously deficient in dental education (1-4).

If there are relatively few guidelines from clinical research and if educators perceive gaps in the treatment planning curriculum, then it follows that systems for evaluation of the quality of dental care—whether at the level of the individual patient or the delivery system—will face problems in judging the appropriateness of delivered dental treatment. A review of the extant evaluation systems confirms that appropriateness is neither well defined nor directly measured.

### **Measuring Quality of Dental Care**

A review of the literature on dental care quality measures reveals two distinctly different emphases, one focused on the oral health-disease status of the patient and other on broader issues of the structure and function of entire delivery systems as they relate to the oral health-disease status of patient populations. The first group of measures is composed of indices that tend to describe changes in incidence or severity, or both, of several elements of dental pathology (primarily caries, lost teeth, periodontal disease, and malocclusion) as a result of dental treatment. Counts of such improvements in oral health status resulting from specific interventions are also employed in public health measures by converting individual statuses into population percentages. Outcomes also tend to be broadened to include such things as patient satisfaction and cost-benefit considerations. And, there is an emphasis on organizational features of delivery systems that affect the population outcomes.

Jago (8) and Cohen and Jago (9) provide excellent comprehensive descriptions of the many indices representing one or the other approach or combinations of the two. My purpose is simply to reiterate briefly the entire range of measures that has been suggested and to place the appropriateness of treatment dimension into this context. My thesis is that appropriateness is only

one of many relevant aspects of quality, that it is of significant practical importance, and that it is not well developed.

Quality in dentistry has been associated traditionally with technical excellence and the mechanical precision of the skilled clinician. This product orientation is inherent in the way clinical dentistry is taught and learned: much time is spent in practicing to match products to the physical features of the excellent or perfect model. Although judgments of technical excellence have always been part of dentistry, systematic concern with their reliability arose only when researchers became interested in comparing the performance of auxiliaries with dentists (10), improving student evaluation (11), and measuring standards in various collective practices such as dental groups and clinics (12-15). Ryge and Snyder (16) recently described an imaginative approach devised to objectify judgments of technical quality. Their system attends to the surface and color, anatomic form, and marginal integrity of amalgam and silicate restorations.

A well-known system for evaluating the quality of dental care delivered to individuals and groups is described in Friedman's "Guide for the Evaluation of Dental Care" (12). It outlines scoring systems and criteria for dental care by direct patient observation and by indirect record reviews. Although it focuses on specific procedures within different disciplines, it also deals with integration of procedures into a comprehensive treatment plan. The explicit criteria here suggest an appropriate general sequence of care and a list of procedures that comprise an adequate oral diagnosis. The focus in this guide is on the comfort, health, and long-term function of the patient. Some examples are provided to identify appropriateness of treatment, but this issue is not dealt with in detail.

Another systematic approach to the development of a reliable dental audit system is that described by Bailit and associates (17). This approach includes observation of patients and records by experts and lay judges, using a system developed by a panel of local dentists, and judgments about diagnosis, treatment planning, and treatment components. Here again the criteria for evaluation are related to completeness of examination and observation of the proper sequence of treatment. The issue of the appropriateness of treatment planning is not dealt with beyond the single procedures level.

Raskin and Bailit (18) recently described the results of an audit of dental procedures billed to an insurance program. Patients were examined by dentists trained in evaluation who used explicit quality criteria to evaluate each restorative and prosthetic service. Oral health

status was also rated in terms of periodontal disease and caries. Relatively few of the procedures were rated less than adequate. Interestingly, variations in quality were reported to be unrelated to oral health status. Although there are other interpretations, these findings could suggest that quality variations in restorations are not valid measures of overall quality of care defined as improvement in oral health status. Although this is to some extent true by definition, the suggestion is that the differences are less related to long-term oral health than is commonly assumed.

A number of indirect measures or ratios have been suggested to estimate quality of care delivered by dental programs. For example, Friedman (12) cites use rates for facilities, recall and treatment completion, and ratios of extractions to root canals, fixed bridges to removable partial dentures, and restorations to extractions. The rates refer to efficiency, and the ratios reflect values for the relative appropriateness of different treatments.

Soricelli (13) stressed ratios such as those of patients whose originally diagnosed needs for treatment were completed to patients partially treated, maintenance to initial care services, longevity and durability of services, and adherence to technical and administrative policies. Although these emphases reflect the public clinic setting, they could be applied to other delivery modes.

Schoen's summary of the 1971 Asilomar Workshop (19) lists such criteria as scope of services, availability, accessibility, eligibility requirements, continuity of care, appropriateness, and technical quality. All but the last two criteria deal with organizational or structural attributes of dental care programs for groups of patients.

The classic exposition of a model describing a broad view of the quality of medical care was provided in 1969 by Donabedian (20). He cited three dimensions of concern: structure, process, and outcome. Structure includes physical facilities, personnel, and other resources available to care delivery. Process relates to the system for interacting with patients in delivery of care. Outcome deals with health status and patient satisfaction measures.

Another system for broadly evaluating care was proposed by Schonfeld (21), who cited four specific levels for evaluating dental care: (a) specific activity, such as single service, task, or restorative procedure, (b) oral cavity, which would relate to effectiveness of the overall treatment plan and its execution, (c) the person, that is, patient satisfaction over and above objective measures of health, and (d) the group or community of recipients of care.

Dental epidemiologists and public health researchers have devised a variety of indices of value to estimate the extent to which dental care has improved the oral health status of consumer populations. As pointed out by Cohen and Jago (9), perhaps the most widely used dental index is the number of DMF (decayed, missing, and filled) teeth, developed in the late 1930s. At least four variants of the DMF index have been used as epidemiologic measures of dental caries to reveal different aspects of the influence of care on dental caries: the Care Index ( $F/DMF \times 100$ ), the Unmet Restorative Treatment Needs ( $D/DF \times 100$ ), the Restorative Index ( $F/FD \times 100$ ), and the Treatment Index—3 ( $F/DMF$ ) % + 2 ( $FC/DMF$ ) % ( $M/DMF$ ) % ÷ 3. The Treatment Index assigns different weights to each of three grades of treatment in relation to their success: a filled tooth ( $F$ ) is the most successful, a filled carious tooth ( $FC$ ) is less successful, and an extracted tooth ( $M$ ) is the least successful.

Some other measures of the outcome of care for a population mentioned by Cohen and Jago (9) are the Dental Services Index, which estimates the cost required to make a population "dentally fit," Friedman's Dental Care Index, and a method suggested by a planning committee of the Regional European Office of the World Health Organization. Friedman's index directly measures features of the delivery system that are believed to affect outcome status without measuring technical quality of care. The WHO proposal conceptualizes four broad criteria for evaluating delivery systems: effectiveness, efficiency, appropriateness, and adequacy. Effectiveness would be measured by reduction in disease, efficiency by cost per unit of service, adequacy in terms of percentage of met needs, and appropriateness in terms of cost effectiveness.

In considering all of these proposals collectively, one is impressed with their diversity. Quality of dental care clearly means very different things to different people; it must be recognized as a complex of factors representing several different levels of concern, each having merit. Although all of these factors serve as indices to improvements in the oral health status of individuals, groups, or populations, they differ widely in terms of their external referents. Some require looking in the mouth; many others do not. They also vary in terms of the extent to which expert judgment is required to categorize observations reliably. Some of the broader criteria are quite far removed from technical decisions; they imply cultural and political value judgments, and thus they are beyond the sole purview of dental experts or public health planners.

Appropriateness of treatment can imply effective-

ness or adequacy. Some treatments are clearly better than others for given problems, independent of cost, and might be described as more "appropriate." However, the most common meaning of appropriateness is cost effectiveness. Is the treatment worth the money? Would it be considered neither undertreatment nor overtreatment? These questions call for value judgments that lie beyond technical issues. Health planners discuss these issues from the viewpoint of populations. The individual consumers of dental services answer them for themselves.

### **The Role of the Patient**

What is the patient's role vis-a-vis the provider's in preparing guidelines for determining appropriateness of dental treatment? Although many considerations of appropriateness obviously are technical and require professional knowledge, at least some are nontechnical value judgments. As such, it would be of interest to know more about lay opinion so that it could be weighted in the eventual development of guidelines.

The general topic of consumer involvement in determining or evaluating health care is highly controversial. Jago (8) presents an interesting overview of the history of consumerism and some of the issues. He points out that while the health professions have traditionally avoided consumer influence, the current trend is toward increased influence by nonprofessionals. Consumerism generally has become fashionable, and much recent legislation has been designed to protect the public's welfare. Even more important in the health care area has been the increase of third-party payment systems in which community sponsorship—whether by governments, labor unions, or others—provides for an organized constituency that commands some influence over the systems. Jago further points out that the consumers' role has been primarily in making care available rather than assessing its quality.

Most health professionals and many others would agree that consumers do not and should not influence technical medical or dental decisions. A strong argument for this position was made by McLaughlin (22), who cited data revealing that 80 percent of the patients in a teamster-funded surgical program—whose care was judged by outside experts to be inadequate—believed that they had received good care. McLaughlin concluded that the consumer is quite helpless in evaluating medical care. Bellin and New (23) hold that even people who can afford to select their health care providers do not fare better than the poor in trying to obtain good care.

On the other hand, Goldberg and associates (24)

argue that in the United States those who can afford it can select and insist on care that satisfies them. Whether or not this is true of medical care—and conventional wisdom suggests that it certainly has some validity—it seems more likely to apply to dental care. Dentists talk about "selling" their patients on dental care. They learn in dental school to think of "ideal" and "practical" treatment plans, with financial ability and willingness to pay an important factor in determining which plan is followed. People who need dental care and who choose not to obtain it or to obtain much less than recommended by their dentists have a role in the treatment selection process. Although much the same point could be made about medical care, the dental situation is far more subject to consumer influence. Except for oral cancer, dental disease is not life threatening. Thus, the consequences of no treatment or undertreatment are less dramatic. In addition, a much larger percentage of dental care is still paid out of pocket rather than by an insurance plan. For these reasons, consumer choice plays a greater role in the determination of dental care than of medical care.

Occlusion problems comprise the only dental area in which consumer opinion has been recognized as valid in determining treatment. Cohen and Jago (9) point out that the definition of malocclusion requires a value judgment that is not one to be made by orthodontic clinicians or dental scientists alone. Because people react differently to occlusal malformities, psychological factors must be considered. In studies that compared patient and professional opinions with respect to malocclusion, significant differences were reported (25–27).

Without debating the issue of what the consumers' role should be, I believe it would be useful to know more about the extent to which the patient actually does affect dental treatment. Moreover, it would be useful to know more about consumers' attitudes concerning what constitutes adequate oral health and to compare these views with those of the dental profession. Research is needed in each of these areas. In the next section, I review the components of oral health and pathology to clarify the range of problems addressed by dental treatment.

### **Components of Oral Health and Pathology**

Cohen and Jago (9) point out that no single index exists to describe oral health status. To describe it one must consider profiles consisting of several indices, each of which deals with a separate disease or dysfunction category. The prominent disease states are dental caries and periodontal disease. The prominent dysfunc-

tions are unrestored missing teeth and malocclusion. In addition, other relevant factors that have been suggested include oral hygiene behavior or cleanliness, enamel opacities and hypoplasias, oral neoplasms, and trauma.

A few attempts to devise composite indices that characterize oral health on a single scale include Lambert and Freeman's Index of Dental Need (28), Oral Health Grading (29), and the National Dental Health Index (9). The Index of Dental Need rates patients on a nominal scale—high, medium, or low—based on the number of carious tooth surfaces, periodontal condition, and occlusion. The Oral Health Grading system classifies patients on a matrix of 17 categories that can be reduced to a 7-point ordinal scale describing severity or oral problems. It deals with dental, periodontal, and prosthetic status. Its major weakness is that it reveals more about oral neglect than dental treatment needs. The National Dental Health Index developed in Canada includes data on the relative prevalence of caries, periodontal disease, and malocclusion and the relative amount of past treatment. To date, it has not been used successfully to calculate a single dental health index score.

Another attempt to summarize oral health status by a single score was made during a study at Meharry Medical College (30). A dentist rated unmet dental needs on a 5-point ordinal scale (none to great) based upon caries, oral hygiene, periodontal disease, occlusion, history, and information about past dental care. As is true for the other composite indices, little is known about this index's reliability or validity.

Nikias and associates (31) recently presented a promising composite oral health index that calls for one-dimensional ratings from experts who are presented with multidimensional oral status profiles. They examined 1,290 adult members of the Health Insurance Plan of Greater New York. Oral health status was described by four levels for each of eight conditions: (a) endentulousness, (b) number of unreplaced missing teeth, (c) gingival and periodontal conditions, (d) percentage of decayed teeth, (e) oral hygiene status, (f) number of sound and untreated teeth, (g) number of filled teeth, and (h) number of replaced teeth. For 939 persons for whom all data were available, 691 profiles were obtained. After several simplification steps in which categories were collapsed, 42 profiles remained. The four basic conditions of missing teeth, gingival and periodontal disease, decayed teeth, and oral hygiene status were used.

To formulate a single index, Nikias and associates obtained oral status ratings from 29 dentists who

formed four panels: clinical practitioners, researchers or research-oriented dentists, public health dentists, and dentists who combined clinical practice with teaching and research. They were asked to rate each of the 42 profiles twice, from best to worst on a scale from 1 to 9. One rating assumed that the patient's age was between 19 and 44, and the other rating assumed it to be 45 or older.

The findings included the following:

- Age failed to produce consistent differences.
- Except for a few extreme profiles that produced agreement, there were great variations among profiles.
- Variations in ratings were not explained by panel membership; there was more variation within than between panels.
- The clinical practitioners generally tended to rank oral status worse (assign higher scores) than the other panelists.
- Disagreement was greatest in relation to profiles of (a) few missing teeth, with high levels of one disease or more and (b) low levels of disease, with large numbers of unreplaced missing teeth.
- Questionnaire responses indicated that the criterion most frequently used for ratings was long-term prognosis, followed by the criteria of function and short-term prognosis. Factors such as patient comfort and satisfaction were less frequently mentioned.

Among the other factors cited by the panelists as needed to guide their ratings were a finer breakdown of the number of missing teeth, location of carious teeth, more clinical detail on periodontal status (based on X-rays and pocket depth), occlusal characteristics, information about soft tissue lesions, past dental history, and socioeconomic and dental behavioral and attitudinal characteristics of the patient.

Nikias and associates concluded that although it is feasible to develop a one-dimensional scale of oral health status, there are problems. Dental professionals' opinions vary to an extent that goes beyond their professional orientations with respect to the relative severity of different oral conditions. Agreement is poorest for oral states that include contrasting levels of health and disease. The authors also pointed out that their profile pattern was designed to create a useful measure for comparing populations' oral health rather than, for example, assessing dental care needs. The list of additional items of information requested suggests that the panelists were thinking somewhat about treatment requirements of the various profiles in addition to current oral health status.

The line of investigation begun by Nikias and associates has potential for revealing more about how various experts perceive oral health status. It could easily be extended to consumer panelists to shed light on the relative values patients place on different states of oral health and on what they consider to be an adequate state. Knowing what patients and dentists consider to be an adequate state of health would help us to understand how they evaluate the appropriateness of various treatments. In addition, we need more research on the diagnosis and treatment planning process in dentistry.

### Studies of Diagnosis and Treatment Planning

Although a great deal of research has been devoted to analysis of the cognitive processes in medical diagnosis and treatment planning, very little has been reported in dentistry. In medicine much emphasis has been placed on diagnosis rather than on treatment planning. This work in medicine was reviewed comprehensively by Elstein and co-workers in 1976 (32).

A common approach has been to describe the diagnostic process in terms of models based on symbolic logic and probability theories. Most of these models are based on the work of Lusted (33); they assume that the diagnostic process consists of matching signs and symptoms to an existing "medical knowledge" of disease symptom and sign categories. This decision-analytical approach has led, for example, to computer modeling of the diagnostic process, computer-assisted medical diagnosis, and other prescriptive models for improving the accuracy and efficiency of the medical inquiry process.

The information processing approach, on the other hand, aims to describe the cognitive thought processes by recording and analyzing the verbalizations of people as they attempt to solve problems. Research in this area reveals that people do not employ the logical algorithms prescribed by decision analysis. They tend to deal with much smaller bits of information than the typical computer model uses.

Elstein and associates (32) indicated further that accuracy in medical diagnosis is much more a function of problem-specific knowledge and perception than mastery of any generalized approach to the solution of diagnostic problems. Thus, solution of one problem is poorly related to solution of another, and it is difficult to judge competence based on performance on a small sample of cases. Other researchers suggest that in chess and logic, as well as in medicine, the differences between experts and less knowledgeable problem solvers are more in the repertory of their experiences

organized in long-term memory than in differences in the planning and problem-solving heuristic devices they employ.

Elstein and associates described the medical inquiry process as a four-stage model. The stages are *cue acquisition* (collecting data), *hypothesis generation* (forming preliminary judgments about the cause of the problem), *cue interpretation* (judgments about whether information confirms or disconfirms tentative hypotheses), and *hypothesis evaluation* (integration of cue weights to select the most probable diagnosis). These researchers found that diagnostic errors are less a function of failure to acquire information than of failure to interpret it correctly. (It has also been found that training in the conscious use of heuristic devices can improve diagnostic accuracy to some extent).

Elstein and associates also described and compared the three basic methodological approaches to the study of clinical decision making—process tracing, regression or lens model, and decision analysis. Process tracing involves observations of the expert performing tasks, for example, the physician progressing through the four stages of the inquiry process. Process tracing leads to descriptions and explanations of how skilled people solve problems. It requires little quantification.

The regression or lens approach calls for simultaneous analyses of any number of variables to describe their empirical weight in the decision. This approach results in a mathematical description of the decision process that describes the process, and, if it is accurate, it also prescribes how the factors should be weighed in subsequent decisions. In other words, if the decision is correct, the observed variable weights can be prescribed for future decision making.

The decision-analysis approach focuses on the independent probabilities of separate problem components, that is, possible disease entities that are used to weigh alternatives. Data are processed sequentially in terms of subjective estimates of probability to develop prescriptive methods for decision making.

All three approaches present a common problem for the researcher—establishing a balance between validity and generalizability. The problem-solving simulation presented to the expert must be similar enough to actual clinical practice to be valid. At the same time, the simulation must be less complex than the actual practice so that the expert can provide a reasonable sample of solutions. Too much abbreviation of the task risks distorting it; too little makes it difficult to observe enough instances for safe generalization. This tradeoff requires judgment.

Only one study in clinical decision making has been

reported in dentistry, that of Proshok and associates (34). They point out the distinction made by Feinstein (35) between the physician's diagnosis based on the patient's signs or symptoms and the pathologist's diagnosis based on direct observation of the disease state or lesion. They suggest that the dentist's process is much like the pathologist's, involving little difficulty in disease identification. Thus, the problem of interest in dentistry is usually the determination of the proper sequence of treatments when the disease is obvious.

Proshok and associates used the process-tracing approach; they observed 20 dentists in a simulated process of diagnosis and treatment planning for 4 case descriptions. Their results suggested that the four-stage model of medical diagnosis and treatment planning described by Elstein and associates does not describe the dentist's behavior accurately. The dentists they observed tended to proceed directly to treatment planning or patient management considerations and to spend less time on hypotheses generation, cue selection, and interpretation. Proshok and associates concluded that if dentists are to function more effectively in diagnosing medical problems, as some have suggested, it may be necessary to modify their training.

It is not surprising that the dental approach to case management is more oriented to treatment than to diagnosis. Dental diseases are few in number and occur with high frequency. Unlike "medical" diseases, the identification of the dental disease is neither complex nor linked directly with a specific treatment. Once the physician makes a correct diagnosis, treatment is often fairly well prescribed. The dentist, on the other hand, spends much less time on diagnosis than on treatment planning.

### **The Need for Guidelines**

From this review of the literature, it is evident that additional research is needed to provide a base of data from which appropriateness may be defined for dental treatment plans. The current state of the art provides for only the vaguest kinds of quantitative comparisons among alternative treatment plans for given states of oral disease. Despite the wide range of indices available to determine oral health status, little systematic evidence exists to guide selection among alternative treatments for either providers or consumers of dental care.

Until better clinical evidence on the relative cost effectiveness of restorative dental procedures is available, the best hope for an appropriateness scale will be based upon a rational blend of expert judgment and personal values. The expert judgment will express the opinions of dentists as to the relative virtues of treatment alternatives in varying situations. The personal values will

express the opinions of consumers about the relative worth of each option. Conventional wisdom suggests that patients who can afford it opt for more expensive care. However, we know relatively little about the decision-making processes of either the experts or the consumers. So long as dental care is purchased on a private, fee-for-service basis, these issues may be of mere academic interest. If, however, dental care is to be funded by public or private third parties, then the interest in a firmer base for decisions about appropriateness is likely to be quite practical.

Two recent examples of expert recommendations appeared in the *American Journal of Public Health*. Bailit and co-workers (36) presented arguments for excluding posterior bridges and crowns from insured dental care benefits as an effective way to contain costs. They pointed out that these services are provided for relatively few people at substantial cost to the programs and that the impact of these services on oral health is dubious. In effect, their position is that these particular treatments may not be appropriate in collectively funded dental care programs. Knudson (37), in the same issue, listed posterior fixed bridges along with major periodontal surgery, restorations in deciduous teeth, and most orthodontics as treatments which should have low (zero) priority in dental insurance plans because of their marginal effects on oral health. He cites a need for a system of priorities for ranking the relative effectiveness and importance of health services.

Suggestions of the kind given by Bailit and associates and by Knudson are likely to provoke controversy. However, as larger numbers of people share in pre-paid dental insurance programs, cost-containment pressures are likely to mount and produce a greater need for priority schemes for evaluating appropriateness of various dental treatments. Such guidelines will be essential for dental insurance planners, but they can also be valuable to the consumer who purchases care on a fee-for-service basis. This consumer can of course elect any treatment whose benefits she or he feels are worth the costs. But, even these personal decisions would benefit from a more detailed priority scheme than is currently available to the dental patient.

Before guidelines can be written, we will need to conduct research along several lines: (a) clinical studies documenting the relative effectiveness of various restorative materials and methods, (b) studies of the ways in which consumers and experts define adequate oral health, and (c) studies of the diagnosis and treatment planning process in dentistry. Although the first line of research calls for observation of actual cases,

the other two could be achieved with simulations. Case materials could be prepared to include the relevant information parameters and then submitted to consumer and expert panels for their decisions. The time for arguments based on our current limited knowledge is past; it is time to extend the limits of that knowledge.

## References

1. Rovin, S.: Curriculum considerations. *In* Workshop proceedings on current and future dental roles in primary care, edited by L. H. Meskin, M. J. Loupe, and R. Micik. Division of Health Ecology, School of Dentistry, University of Minnesota, Minneapolis, 1976, pp. 59-75.
2. Goldhaber, P.: Curriculum considerations (a review). *In* Workshop proceedings on current and future dental roles in primary care, edited by L. H. Meskin, M. J. Loupe, and R. Micik. Division of Health Ecology, School of Dentistry, University of Minnesota, Minneapolis, 1976, pp. 79-83.
3. Oliver, R. C.: Curriculum considerations (a review). *In* Workshop proceedings on current and future dental roles in primary care, edited by L. H. Meskin, M. J. Loupe, and R. Micik. Division of Health Ecology, School of Dentistry, University of Minnesota, Minneapolis, 1976, pp. 75-79.
4. Schoen, M. H.: Manpower distribution and costs (a review). *In* Workshop proceedings on current and future dental roles in primary care, edited by L. H. Meskin, M. J. Loupe, and R. Micik. Division of Health Ecology, School of Dentistry, University of Minnesota, Minneapolis, 1976, pp. 141-145.
5. Boozer, C. H., Rasmussen, R. H., and Barrett, R.: Survey of curriculum and instruction: oral diagnosis. *J Dent Educ* 40: 800-804, December 1976.
6. Cohen, L., editor: Oral diagnosis and treatment planning. Charles C Thomas, Springfield, 1973.
7. Goldman, H. M., et al.: Current therapy in dentistry. C. V. Mosby Co., St. Louis, 1968.
8. Jago, J.: Issues of assurance of quality of dental care, *JADA* 89: 854-865, October 1974.
9. Cohen, L., and Jago, J.: Toward the formulation of sociodental indicators. *Int J Health Serv* 6: 681-698, April 1976.
10. Lotzkar, S., Johnson, D., and Thompson, M.: Experimental program in expanded functions for dental assistants: phase 1-baseline and phase 2-training, *JADA* 82: 101-122, January 1971.
11. Houpt, M. I., and Kress, G.: Accuracy of measurement of clinical performance in dentistry. *J Dent Educ* 37: 34-36, July 1973.
12. Friedman, J. W.: A guide for the evaluation of dental care. School of Public Health, University of California, Los Angeles, 1972.
13. Soricelli, D. A.: Methods of administrative control for the promotion of quality in dental programs, *Am J Public Health* 58: 1723-1737 (1968).
14. Abromowitz, J.: Planning for the Indian Health Service. *J Public Health Dent* 31: 70-78, spring 1971.
15. Cons, N. C.: Method for the post-treatment evaluation of dental care. *J Public Health Dent* 31: 104-108, spring 1971.
16. Ryge, G., and Snyder, M.: Evaluating the clinical quality of restorations, *JADA* 87: 369-377, August 1973.
17. Bailit, H., et al.: Quality of dental care: development of standards. *JADA* 89: 842-853, October 1974.
18. Raskin, M., and Bailit, H.: Quality assessment of insured patients. Paper presented at meeting of the International Association of Dental Research, Las Vegas, June 1977.
19. Schoen, M. H.: Quality evaluation of dental care programs. *In* Councils on dental health and dental care programs. Proceedings of the 22d National Dental Health Conference. American Dental Association, Chicago, 1971, pp. 400-408.
20. Donabedian, A.: A guide to medical care administration: medical care appraisal. American Public Health Association, New York, vol. 2, 1969.
21. Schonfeld, H. K.: Evaluation of the quality of oral care systems. *In* Oral health, dentistry, and the American public, edited by W. E. Brown. University of Oklahoma Press, Norman, 1974, pp. 229-278.
22. McLaughlin, M. C.: Transmutation into protector of consumer health services, *Am J Public Health* 61: 1996-2004, October 1971.
23. Bellin, S. S., and New, P. K.: Neighborhood health centers. *Inquiry* 6: 62-63, June 1969.
24. Goldberg, G. A., Trowbridge, F. L., and Buxbaum, R. C.: Issues in the development of neighborhood health centers, *Inquiry* 6: 37-46, March 1969.
25. Horowitz, H. S., Cohen, L. K., and Doyle, J.: Occlusal relations in children in an optimally fluoridated community: IV. Clinical and socio-psychological findings. *Angle Orthod* 42: 189-201 (1971).
26. Howitt, J. W., Stricker, G., and Henderson, R.: Eastman Esthetic Index. *NY State Dent J* 33: 215-220 (1967).
27. Kean, M. R., Harkness, E. M., and Koskinen, L. K.: Malocclusion in Dunedian school children. Abstracts Nos. 11 and 12. New Zealand Section of IADR 9th annual meetings. *J Dent Res* 52: 584-585 (1973).
28. Lambert, C., and Freeman, H. E.: The clinic habit. College and University Press, New Haven, 1967, pp. 45-53.
29. Bulman, J. S., Richards, N. D., Slack, G. L., and Wilsocks, A. J.: Demand and need for dental care: a sociodemographic study. Oxford University Press, London, 1968.
30. Carr, W., and Wolfe, S.: Unmet needs as a sociomedical indicator. *Int J Health Serv* 6: 417-430 (1976).
31. Nikias, M., Sollecito, W., and Fink, R.: An oral health index based on ranking of oral status profiles by panels of dental professionals. *J Public Health Dent* 39: 16-26, winter 1979.
32. Elstein, A. S., Shulman, L. S., and Sprafka, S. A.: Final report: an analysis of the medical inquiry process. Office of Medical Education Research and Development, Michigan State University, East Lansing, 1976.
33. Lusted, L. B.: Introduction to medical decision making. Charles C Thomas, Springfield, 1968.
34. Proshok, J., Loupe, M., and Serunian, J.: The process of dental diagnosis: an initial analysis. Paper presented at the annual meeting of the American Educational Research Association, New York, April 1977.
35. Feinstein, A. R.: Clinical judgment. Robert F. Kreiger Publishing Company, Huntington, N.Y., 1967.
36. Bailit, H., Raskin, M., Reisine, S., and Chiriboga, D.: Controlling the cost of dental care. *Am J Public Health* 69: 699-703, July 1979.
37. Knudson, J.: Controlling the costs of dental health care insurance. *Am J Public Health* 69: 647-650, July 1979.